

Groundwater

Ambient Groundwater Quality Monitoring Network

Background

The quality of shallow groundwater is important because it is the water that recharges deeper aquifers and constantly feeds the water levels of our surface streams and wetlands. Recently, DEP, in partnership with the U.S. Geological Survey (USGS), redesigned its Ambient Groundwater Quality Network. The original (pre-1999) network used public supply, domestic, irrigation and other existing wells to focus primarily on determining the impacts of surrounding geological rock formations upon groundwater quality. The redesigned network provides information about land-use-related nonpoint source pollution impacts to shallow groundwater quality. It consists of 150 shallow wells, 30 of which are sampled each year on a five-year cycle. DEP and USGS completed the first cycle in 2004.

Samples from network wells are taken from just below the water table, so the groundwater should be relatively young. By monitoring younger groundwater rather than the older groundwater in deeper systems, we are able to evaluate how current land-use activities are affecting groundwater quality, and take more immediate corrective actions, if necessary.

The wells in the system have been placed so that 60 are located in agricultural areas, 60 in urban/suburban areas, and 30 in undeveloped areas. The wells installed in the undeveloped land provide a baseline to evaluate impacts by urban and agricultural land uses.

DEP and USGS test for general water-quality parameters such as temperature, dissolved oxygen, pH and total dissolved solids. These parameters yield information about the general character of shallow groundwater. For example, increased water temperatures in urban areas are likely reflecting contact with paved surfaces that have a higher average temperature than the surrounding air. Other parameters include trace elements, such as arsenic and cadmium; nutrients; volatile organic compounds; pesticides, and radioactivity.

DEP has results from 71 wells in the Lower Delaware and Atlantic Coastal regions that were sampled in the first three years of the redesign. The remaining results are not yet available.

The Lower Delaware and the Atlantic Coastal Water regions are in New Jersey's Coastal Plain, a region of sand,

silt, clay and gravel that forms a multi-layered aquifer system containing one major unconfined aquifer and four major confined aquifer systems.

A confined aquifer is an aquifer below the ground that is saturated with water. Layers of impermeable material are both above and below the aquifer, causing it to be under pressure so that when the aquifer is penetrated by a well, the water will rise above the top of the aquifer. An unconfined aquifer's upper water surface is at atmospheric pressure, and thus is able to rise and fall.¹ Groundwater in unconfined aquifers is most significantly impacted by nonpoint source pollution.

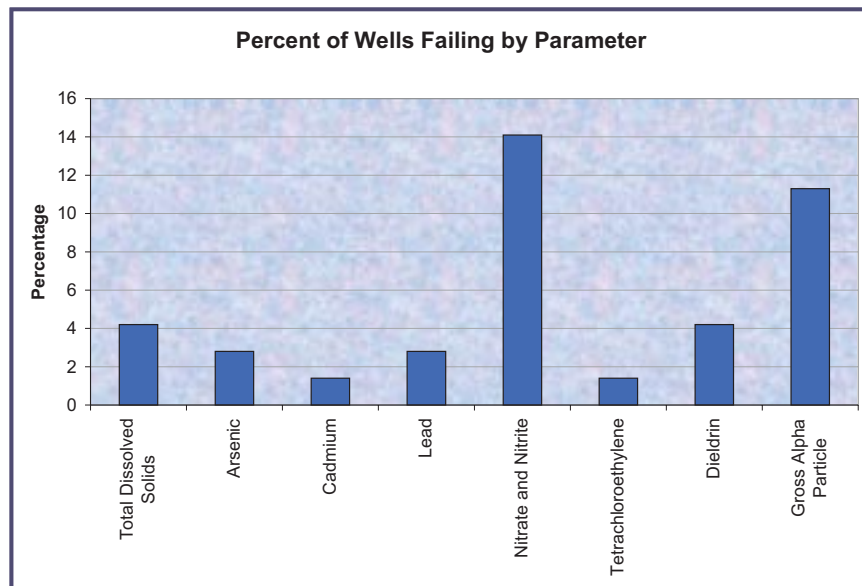
Status and Trends

DEP has results of samples collected and analyzed during 1999, 2000 and 2001 from 71 wells in the redesigned Ambient Groundwater Quality Monitoring Network. Results of pH testing are not included in the figure below. It should be noted, however, that 94 percent of wells tested failed for pH, but the groundwater of the Atlantic Coastal Region is naturally acidic, so the low pH probably is not due to man-made contamination. DEP's Bureau of Water Monitoring Management and the USGS collected samples from these wells and analyzed them at the USGS National Water Quality Laboratories in Denver, Colo.

The following table shows different contaminants' groundwater quality criteria (GWQC), which is the safe limit determined for a contaminant. The subsequent graph shows the percentage of wells that exceed GWQC for each contaminant:

| Parameter | GWQC |
|------------------------|-----------|
| pH | 6.5-8.5 |
| Total Dissolved Solids | 500 mg/L |
| Arsenic ¹ | 5 ug/L |
| Cadmium | 4 ug/L |
| Lead | 5 ug/L |
| Nitrate + Nitrite | 10 mg/L |
| Tetrachloroethylene | .4 ug/L |
| Dieldrin | .002 ug/L |
| Gross Alpha Particle | 15 ug/L |

¹ The GWQC of 0.02 ug/L is below the reporting limits for arsenic and therefore the state safe drinking water standard of 5 ug/L is used for comparison.



Outlook and Implications

Because the redesigned network has completed only one round of sampling, it is hard to determine the outlook of our groundwater supplies. As more sampling is performed, the DEP will use this data to make sound management and policy decisions to protect the quality of New Jersey's groundwater.

More Information

<http://www.state.nj.us/dep/wmm/bfbm/groundwater.html>

<http://www.state.nj.us/dep/wmm/bfbm/index.html>

For more information on groundwater quality with respect to drinking water see Drinking Water Quality, in this Environmental Trends series.

References

¹ <http://interactive2.er.usgs.gov/faq/> Dec. 14, 2004

Unless cited, all information comes from Serfes, M and J. Gibs. Land use impacts to shallow groundwater quality in the Lower Delaware and Atlantic Coastal Regions. 2004. New Jersey's integrated water-quality report.